45.

$$f(x)=\begin{cases} x, & 0\le x<1 \\ 0, & x=1 \end{cases}$$

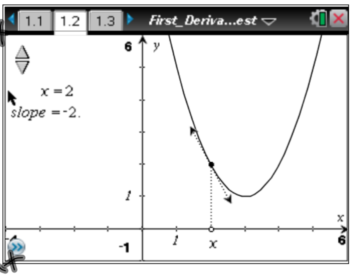
$$f'(x)=\begin{cases} 1, & 0<x<1 \\ \ast, & x=1 \end{cases}$$

Oct 16-9:37 AM

4.3 Connecting f ' and f '' with the graph of f

first derivative test for local extrema of continuous functions

what does f ' tell us about the graph of f ?



$f'>0$, f inc

$f'<0$, f dec

f' $+\ 0\ -$ f has a max

$+\ \ast\ -$

f' $-\ 0\ +$ f has a min

$-\ \ast\ +$

{for all tests - f must be continuous}

f' $+\ 0\ +$

$+\ \ast\ +$

f' $-\ 0\ -$

$-\ \ast\ -$

Oct 18-5:28 PM

Oct 16-9:37 AM

find the local extrema:

y=(x^2 - 3) e^x

$y' = (x^2-3)e^x + 2xe^x = 0$

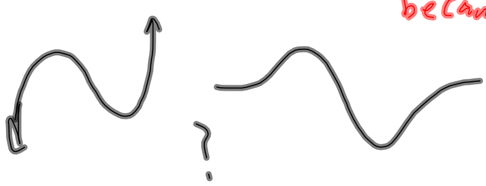
$y' = e^x(x^2-3+2x) = e^x(x^2+2x-3) = 0$

$y' = e^x(x-1)(x+3) = 0 \qquad x = 1, -3$

y': $+$ 0 $-$ 0 $+$ (at $x=-3$ and $x=1$)

max at $x=-3$ — max is $y = 6e^{-3}$ — because y' changes from $+$ to $-$

min at $x=1$ — min is $y = -2e$ — because y' changes from $-$ to $+$



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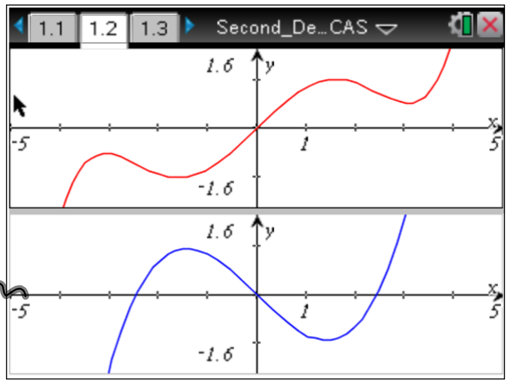
concavity test



++ f''

$y'' > 0$ y concave up

$y'' < 0$ y concave down

-- f''

inflection pts where y'' changes sign

Oct 18-6:25 PM

Find all points of inflection for the graph of $y = e^{-x^2}$

$y' = -2xe^{-x^2}$

$y'' = -2x(-2xe^{-x^2}) + e^{-x^2} \cdot (-2) = 0$

$e^{-x^2}(4x^2 - 2) = 0 \qquad x = \pm\sqrt{\frac{1}{2}}$

$4x^2 = 2$

$x^2 = \frac{1}{2}$

y'' + 0 − 0 +

$-\sqrt{\frac{1}{2}} \qquad \sqrt{\frac{1}{2}}$

inflection points at $x = \pm\sqrt{\frac{1}{2}}$

because y'' changes sign

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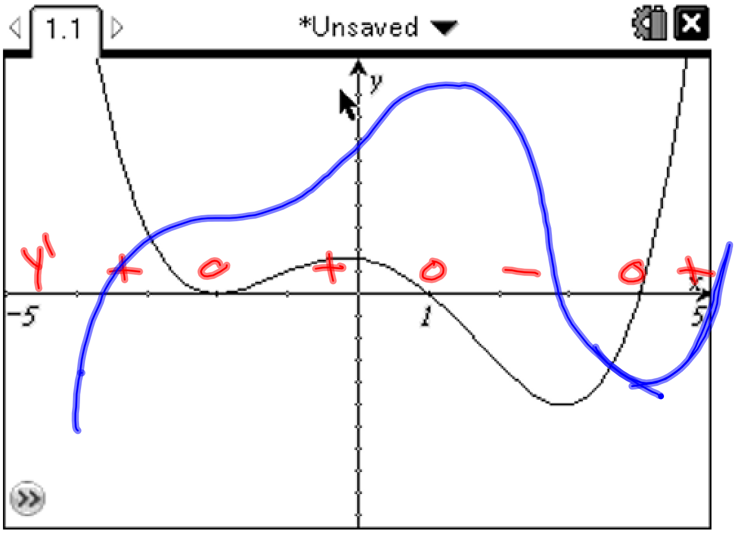
This is the graph of f '. Sketch a possible graph of f



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second derivative test for local extrema

if $f' = 0$ & $f'' > 0$ then f has a min

if $f' = 0$ & $f'' < 0$ then f has a max

Find the local extrema using the second derivative test

y=x^3 -12x - 5

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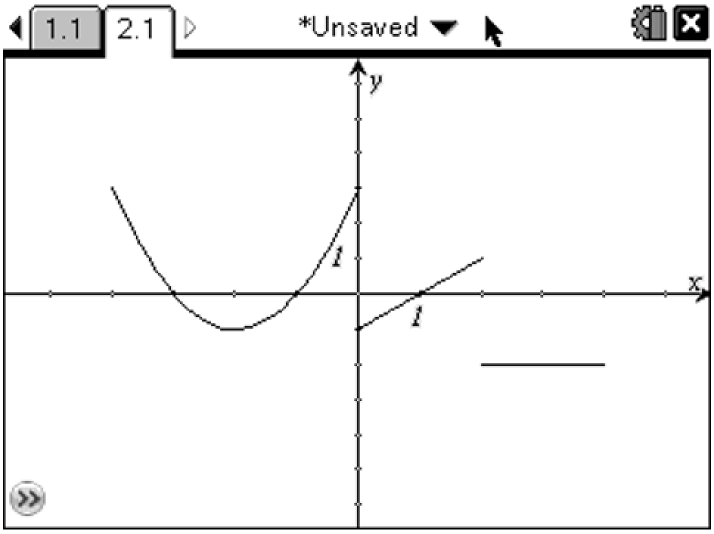
Given the graph of f ' sketch a possible graph of f



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